Rapid Epidemiologic Assessment of Chlorine Exposure After a Train Derailment - South Carolina, 2005

Centers for Disease Control and Prevention

2005 Preparedness Conference

Objectives

- Understand the importance of inter-state collaborations required for a cross-border epidemiological investigation.
- Identify the signs and symptoms associated with chlorine exposure.
- Be able to identify the components required of surveillance data from healthcare facilities associated with an acute chemical event.

6 Jan 2005

- At 0240 a Norfolk Southern railway train missed a switch and struck a parked locomotive, causing its derailment and the release of chlorine.
- At 0400 SCEMD duty officer, DHEC duty officer, SLED and Aiken County EOC notified.
- At 0700 DHS begins requesting information.


Photo courtesy SCDHEC
1/6/2005

6 Jan 05 (cont'd)

- 0720 FENA Region IV notified
- 0800 SEOC goes to OPCON 1. ESF 5,6,8,10,13,16 activated.
- 0821 Burke and Richmond County, GA notified.
- 0824 first Decon site and shelter established
- 0930 EPA arrives on scene


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7 Jan 05

- OSHA representative is deployed
- USDA representative is deployed
- Aiken County and ESF 8 begin planning for possible hospital evacuations

8 Jan 05

- 11 operational railcars moved and being decontaminated
- DHEC 4-person epidemiology team deploys to incident area.
- Requested permission from FEMA to deploy pre-position equipment program (PEP) assets.

Background

- Chlorine gas can be pressurized and cooled to change it into a liquid so that it can be shipped and stored. When liquid chlorine is released, it quickly turns into a gas that stays close to the ground and spreads rapidly.

- Can be recognized by its pungent, irritating odor, which is like the odor of bleach. The strong smell may provide an adequate warning to people that they have been exposed.

- Appears yellow-green in color.

Initial Signs and Symptoms - 1

- During or immediately after exposure to dangerous concentrations of chlorine, the following signs and symptoms may develop:
  - Coughing
  - Chest tightness
  - Burning sensation in the nose, throat, and eyes
  - Watery eyes
  - Blurred vision
  - Nausea and vomiting
  - Burning pain, redness, and blisters on the skin if exposed to gas, skin injury similar to frostbite if exposed to liquid chlorine

Initial Signs and Symptoms - 2

- Difficulty breathing or shortness of breath (may appear immediately if high concentrations of chlorine gas are inhaled, or may be delayed if low concentrations of chlorine gas are inhaled)
- Fluid in the lungs (pulmonary edema) within 2 to 4 hours
- Showing these signs or symptoms does not necessarily mean that a person has been exposed to chlorine.

Long-term health effects

- Long-term complications from chlorine exposure are not found in people who survive a sudden exposure unless they suffer complications such as pneumonia during therapy.

- Chronic bronchitis may develop in people who develop pneumonia during therapy.

Rapid Epidemiological Assessment

- Assess the public health impact associated with exposure to chlorine in patients.
- Assess the relationship between exposure location to acute and chronic illness.
- Gathering of patient-specific information for monitoring of long-term health effects, psychosocial consequences for follow-up monitoring.

Sources of Data

- ED and hospital admission logs
- Reporting by private physicians
- In-person and telephone interview
  - Exposure location and description
  - Symptoms
  - Medical care
  - Preexisting conditions
  - Psychosocial

Demographics and Preexisting Conditions

Demographics & Preexisting Conditions, N=217	Total No (%)
Age, in years	
Mean	38
Range	<1-76
Male	136 (63)
Preexisting	
Asthma, n=198	31 (16)
COPD, n=191	4 (2)
Emphysema, n=196	4 (2)
Cigarette Use, n=217	
Never	119 (55)
Current	71 (33)
Former	27 (12)

Spectrum of Symptoms

Symptom (n=194)	Number Reporting (%)
Cough	154 (79)
Eye burning	146 (75)
Shortness of breath	138 (71)
Headache	114 (59)
Chest pain	108 (56)
Nausea	101 (52)
Nose burning	99 (51)
Choking	94 (48)
Cough up phlegm	89 (46)
Dizziness	87 (45)
Vomiting	63 (32)

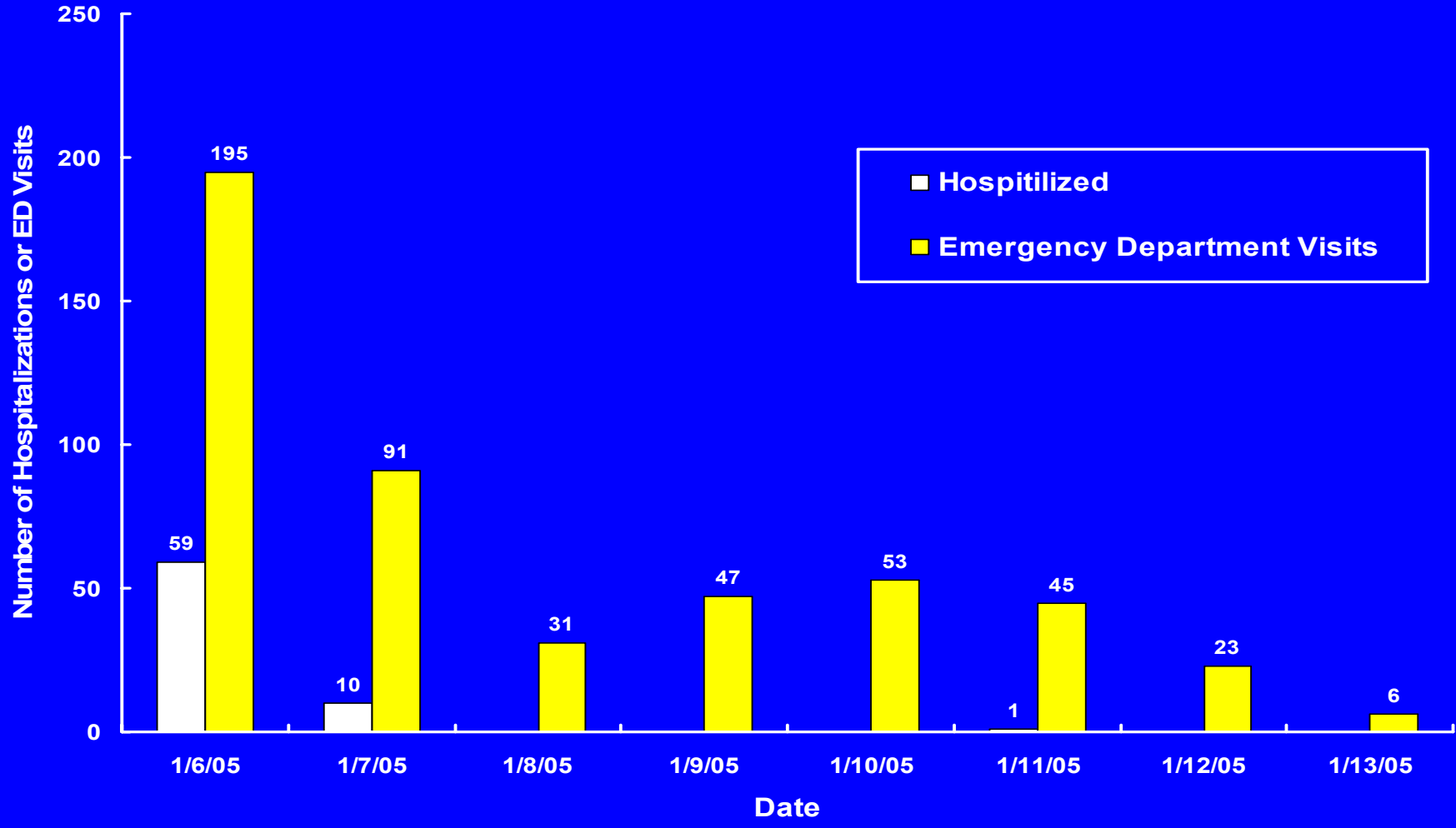
Mode of Transportation to Care

Transport (n=255)	Number Reporting (%)
Friend transported	94 (36.9)
Self transport	73 (28.6)
EMS	47 (18.4)
Didn’t seek care	22 (8.6)
Other	8 (3.1)
Unknown	11 (4.3)

Medical Care

Facility	ED Visits N=569	Hospitalizations N=72
Aiken		
Aiken Regional	303 (53%)	26 (36%)
Augusta		
University	184 (32)	16 (22)
MCG	43 (7)	10 (14)
Doctor's	24 (4)	13 (18)
St. Joseph's	8 (1)	3 (4)
Columbia		
Lexington	5 (1)	3 (4)
Palmetto	1 (<1)	1 (1)
Other		
Barnwell County	1 (<1)	-
Edgefield	1 (<1)	-

Number of Hospitalizations and Emergency Department Visits Associated with Graniteville, SC Chlorine Exposure, January 6-13, 2005



Location of Exposure

Main Exposure N = 155	Deceased No (%)	Hospital No (%)	ED No (%)	Total
Mill worker	6 (10)	30 (51)	23 (39)	59
Graniteville resident	1 (2)	6 (10)	51 (88)	58
Close town		1 (8)	11 (92)	12
Vehicle (far)			11 (100)	11
Neighboring town			7 (100)	7
Vehicle (close)	1 (17)	1 (17)	4 (67)	6
Other	1 (50)		1 (50)	2

Exposure Categories, by Outcome

Case Classification(n=179)	Number (%)
Deceased	9 (5.0)
ICU/Ventilator	13 (7.3)
Hospitalized	21 (11.7)
ED/Repeat Visits	21 (11.7)
ED/Significant Respiratory Sx	25 (14.0)
ED/Moderate Respiratory Sx	49 (27.4)
ED/Not seen	11 (6.1)
Physician's office visit	10 (5.6)
No Medical Care w/ Sx	10 (5.6)
No Medical Care w/o Sx	10 (5.6)

Conclusions

- Rapid epidemiological assessments a useful tool for gauging the extent of public health impact.
- Importance of cross-border collaborations in epidemiological investigations.
- Need for availability of ED data for classifications of patients admitted.

Conclusions - 2

- Mass casualty response planning needs to consider the burden of self-reports as well as transported patients seeking care (e.g. not just the “worried well”).
- Subject matter expertise on epidemiological response teams.
- Planning for long-term involvement.

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